Vol. 16. Parts 4–6. Pp. 33–64. 1st July, 1941

THE PROCEEDINGS
OF THE
ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Series A.
GENERAL ENTOMOLOGY

World List abbreviation: *Proc. R. ent. Soc. Lond.* (A)

CONTENTS

PAGE

Buxton, Professor P. A., F.R.E.S. A map projection of biological interest . . . . 34, 1 fig.

Cockayne, E. A., D.M., F.R.C.P., F.R.E.S. Prothetely in a larva of *Smerinthus* hybr. *hybridus* Stephens (Lepidoptera) . . . . 55–59, 9 figs.

Evans, Brigadier W. H., C.S.I., C.I.E., D.S.O., F.R.E.S. The resting positions of butterflies (Lepid. Rhopalocera) 33

Griffin, Francis J., and Griffin-Gillen, Joséphine. The terminology used by Jacob Hübner 49–54

Hickin, N. E., Ph.D., F.R.E.S. Methods used in rearing small insects infesting stored food products . . . . . . 35–38, 4 figs.

Hinton, H. E., Ph.D., F.R.E.S. Notes on the internal anatomy and immature stages of *Mycetophagus quadripustulatus* (Linnaeus) (Coleoptera, Mycetophagidae) . . . . 39–48, 21 figs.

Vanderplank, F. L., B.Sc. Activity of *Glossina pallidipes* and the lunar cycle (Diptera) . . . . 61–64, 1 graph

Book Notices 54, 60

LONDON:
PUBLISHED BY THE SOCIETY AND
SOLD AT ITS ROOMS, 41, QUEEN'S GATE, S.W.7

Price 9s. 0d.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

Founded, 1833. Incorporated by Royal Charter, 1885.

PATRON—HIS MAJESTY THE KING.

OFFICERS and COUNCIL for the SESSION, 1941–1942.

K. G. Blair, D.Sc., *President.*

Prof. P. A. Buxton, M.A.
G. Fox-Wilson, N.D.H. } *Vice-Presidents.*
Hugh Main, B.Sc.

Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., *Treasurer.*

N. D. Riley, *Secretary.*

F. J. Griffin, A.L.A., *Registrar.*

Other Members of Council.

Prof. H. G. Champion, C.I.E., M.A.
E. A. Cockayne, M.A., M.D., F.R.C.P.
A. S. Corbet, D.Sc., Ph.D., F.I.C.
Col. F. A. Labouchere.
A. M. Massee, D.Sc.
C. Potter, B.Sc., Ph.D.
O. W. Richards, M.A., D.Sc.
The Hon. Miriam Rothschild.
J. Smart, B.Sc., Ph.D.
W. H. T. Tams.
A. Welti.

Finance and House Committee.

A. Welti (Chairman).

H. M. Edelsten.
A. G. Gabriel.
C. N. Hawkins.
Francis Hemming, C.M.G., C.B.E.
J. Smart, B.Sc., Ph.D.

Publication Committee.

O. W. Richards, M.A., D.Sc. (Chairman).

E. A. Cockayne, M.A., M.D., F.R.C.P.
G. Fox-Wilson.
A. M. Massee, D.Sc.
W. H. T. Tams.
V. B. Wigglesworth, M.A., B.Ch., M.D., F.R.S.

Library Committee.

Prof. P. A. Buxton, M.A. (Chairman).

E. B. Britton.
A. S. Corbet, D.Sc., Ph.D., F.I.C.
B. M. Hobby, M.A., D.Phil.
F. Laing.
R. W. Lloyd.

Committee for the Protection of British Insects.

W. G. Sheldon (Chairman).

Capt. E. Bagwell-Purefoy.
C. L. Collenette.
W. J. Dow.
J. C. F. Fryer, O.B.E., M.A.
Col. F. A. Labouchere.
N. D. Riley.
H. M. Edelsten (Secretary).

The Executive Officers of the Society are *ex-officio* members of all Committees.

DELEGATES OF THE SOCIETY TO:

1. **British National Committee for Biology** (Royal Society).
   Sir Guy A. K. Marshall, C.M.G., D.Sc., F.R.S., appointed 1939.
   Dr. Karl Jordan, F.R.S., appointed 1936.
2. **International Congress of Entomology** (Berlin 1938).
   J. C. F. Fryer, O.B.E., M.A. *Francis Hemming, C.M.G., C.B.E.*
   A. D. Imms, M.A., Sc.D., F.R.S.
3. **Local Committee of Management of Wicken Fen.**
   Mr. H. M. Edelsten. *Mr. E. C. Bedwell.*
   [Delegates nominated by Committee for the Protection of British Insects.]
4. **National Trust for Places of Historic Interest or Natural Beauty.**
   Mr. W. G. Sheldon, appointed 1922.
5. **New Forest Association.**
   Mr. W. Fassnidge, appointed 1934.
6. **Royal Meteorological Society. Phenological Committee.**
   Dr. C. B. Williams, appointed 1937.

THE RESTING POSITIONS OF BUTTERFLIES (LEPID. RHOPALOCERA)

By Brigadier W. H. Evans, C.S.I., C.I.E., D.S.O., F.R.E.S.

I am afraid the title of my communication is misleading. I can tell you nothing, which the majority of you do not know already, about the resting positions of British butterflies and they are adequately described in both Frohawk and Sandars books on the subject. My purpose is to ask you in your travels abroad to note and record anything abnormal in the resting positions of exotic butterflies, for the reasons which I will explain.

The ordinary butterfly on alighting assumes what may be called the alert position with the wings held vertical, pressed tightly together and the fore-wing well forward. When he feels secure he may proceed to open and close his wings, a frequent action when feeding or searching for food. Or he may bask with his wings flat. When he wants to rest, in dull weather or at night, he holds his wings erect, but with the fore-wing pressed well back inside the hind-wing : many sit with their heads down by day, reversing the position at night.

In the British butterflies there are two exceptions to the normal attitudes. The " Grizzly Skipper," *Erynnis tages* (L.) rests with his wings open, but folded right back like a Noctuid moth. The tawny skippers belonging to the genera *Hesperia*, *Ochlodes* and *Thymelicus* often bask with the fore-wings vertical and the hind-wings horizontal. In the tropics there is a large number of species belonging to the subfamily PYRGINAE of the HESPERIIDAE which appear invariably to sit with their wings spread flat, some species alighting thus on the upperside of a leaf, others on the underside.

Now one of the most difficult problems I have ever had to tackle has been the classification of the HESPERIIDAE, as the differentiating characters available are very much fewer than in any other group of butterflies. Certain genera present some outstanding feature which appears to serve as the basis for a subfamily or a group of genera, but there remains a large number of genera difficult to place in any particular group. A knowledge of the early stages would of course help very materially, but here the information available is fragmentary and is likely to be acquired very slowly. It will be seen that information regarding an additional character, such as the resting position, might prove of the greatest service to the taxonomist. I ask therefore that collectors in the tropics should note, when they see a Hesperiid, whether it alights with its wings flat, above or below a leaf, and whether it rests noctuid-wise or with the fore-wing vertical and the hind-wings horizontal.

A MAP PROJECTION OF BIOLOGICAL INTEREST

By Professor P. A. Buxton, F.R.E.S.

(*London School of Hygiene and Tropical Medicine.*)

If one wishes to show a large part or the whole of the world's surface on a flat map, there must be great distortion, and it is useless to search for the perfect projection. It is a matter of convenience to find the projection which is best suited to a particular purpose.

For mapping the distribution of terrestrial organisms it seems that Boggs' projection has great value. As the figure shows, the distortion is mainly in the oceans. The projection is recentred for each continental mass, so that the continents are little distorted, except Asia, which has an enormous extent in latitude. The relation of island groups to one another is not much disturbed, except that the east and west Pacific are shown completely separated.

It must be admitted that though this projection is valuable for showing the present distribution of terrestrial plants and animals, it is not suitable for considering the changes in the distribution of land and water (and organisms) which have occurred in past epochs.

Outlines on this projection are obtainable in London from Geographical Publications Ltd., by whose permission the figure is here reproduced.

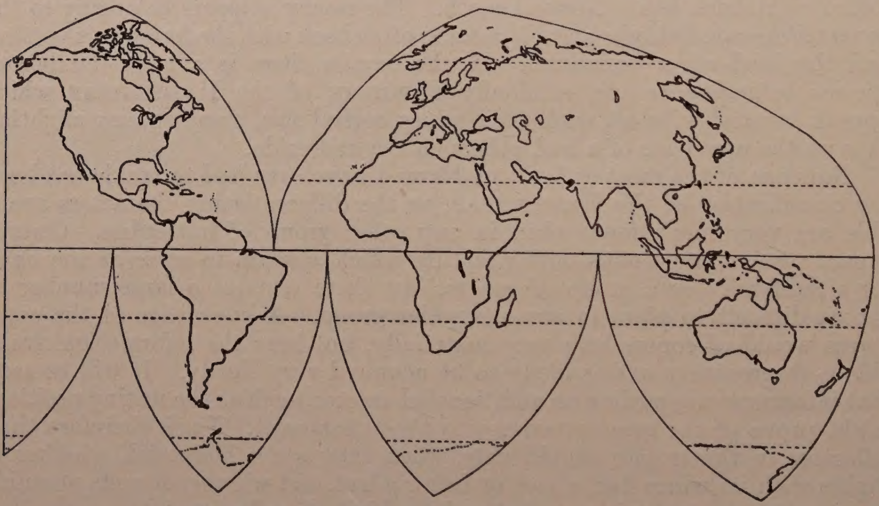


Fig. 1.—Map of the world on Boggs' projection.

METHODS USED IN REARING SMALL INSECTS INFESTING STORED FOOD PRODUCTS

By N. E. Hickin, Ph.D., F.R.E.S.

In experiments carried out recently on the food and water requirements of Ptinid beetles, several thousands of these small insects were reared successfully under conditions of controlled humidity and temperature. The methods used are described in this communication, as well as the methods devised for sieving the finely powdered foodstuff for isolation of the live stages—eggs, young larvae, etc.

I wish to thank Dr. O. W. Richards for advice and suggestions.

Culture Cages.

The method of Buxton and Mellanby (1) of using celluloid cylinders was modified by the use of glass cylinders (fig. 1). It was thought that the camphor content in celluloid might be inimical to insects. Sections were cut from wide diameter glass tubing. Diameters of two inches and three inches were found to be practicable. Bolting silk of 90 meshes to the inch was used to cover the ends of the glass cylinders; it was held firmly in position by means of brass clips.

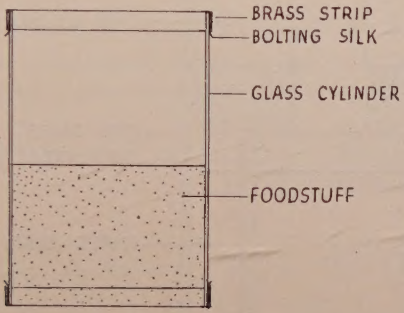


Fig. 1.

Wide diameter glass tubing (2″ and 3″) may be cut easily by the following method: a small cut is made on the glass surface with a sharp file. Strips of blotting-paper, $\frac{1}{2}$″ wide, are then wetted with cold water and wrapped around the tubing, one strip on each side of the cut and about $\frac{1}{4}$″ apart. The tube is then rotated in a large air-gas flame (but not sufficient air to produce a blue cone). After about 20–30 secs. the required length of tubing splits off and now only requires the sharp edges grinding off with emery paper moistened with turpentine.

The brass clips are made by joining $\frac{1}{8}$″ strips of brass foil using a glass cylinder as a former, and fixing the joint with solder. A piece of thin paper under the join insulates the heat (from the operation of soldering) from the glass and also gives the correct diameter for holding the silk on to the glass with a tight fit. A slip of paper giving the identification key (species, foodstuff, humidity, etc.) is wedged between the clip and the silk. The larvae of some species are able to bite their way through bolting silk especially at high humidities, and in this case thin lead foil should be used in place of bolting silk at the lower end of the cage after the foodstuff has attained equilibrium with the desired relative humidity. An alternative method of construction of culture cages for use with such larvae would be to solder discs of copper gauze (90 meshes to the inch) on to the brass clips. The clips could then be nickel plated in order to prevent possible corrosion of the copper by the damp foodstuffs.

REGULATION OF TEMPERATURE.

The humidity chambers containing the cultures were kept in thermostatically controlled ovens of the standard type. The latter were maintained at 27° C., which is a convenient temperature for experiments of this kind. With foodstuffs in equilibrium with high relative humidities such as 70% and 80%, however, the growth of moulds is very rapid, but if the temperature is fixed at 20° C. the growth of moulds is much less rapid, and, in species with a rapid life-cycle, it may be possible under these conditions to rear a complete life-cycle before the advent of mould formation.

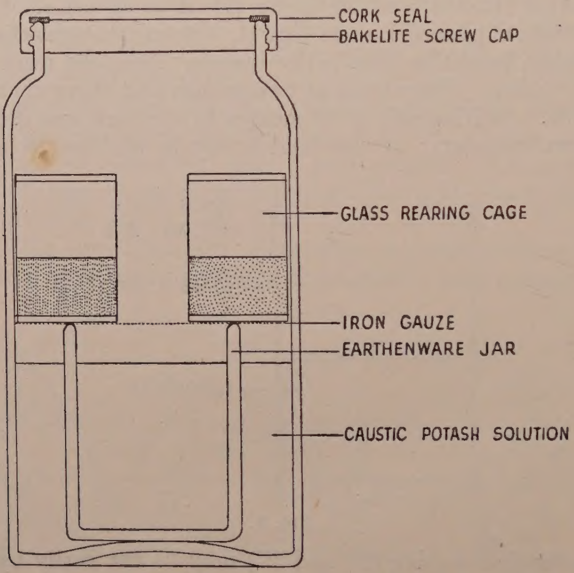


FIG. 2.

REGULATION OF HUMIDITY.

This was carried out mainly by the method of Buxton and Mellanby (1). "Seven-pound" jars with very little shoulder and bakelite screw stoppers (cork inserts) were used as the humidity chambers (fig. 2). These jars were 6″ in diameter and about 12″ in overall height. The neck was $4\frac{1}{2}''$ in width. One litre of humidity-controlling fluid was poured carefully into the jar and a disc of wide mesh iron or brass gauze was supported on a glass or earthenware cylinder which projected $\frac{3}{4}''$–1″ above the level of the fluid. From four to six culture cages each containing about 50 c.c. of foodstuff (sieved through 60 mesh) were then placed on the gauze shelf. The culture foodstuffs were allowed fourteen days to come into equilibrium with the humidity before infestation. The humidity-controlling fluid for relative humidities between 10% and 90% was caustic potash solution of known strength made up to concentrations given by Buxton and Mellanby (1). Caustic potash solution has the advantage that it does not give off noxious or toxic fumes when particles of foodstuff drop into it from the culture cages. Also the carbon dioxide from respiration is absorbed.

The caustic potash solutions were changed every twelve weeks, and tests showed that the relative humidities could be kept within 1% of that required. The solution giving 90% relative humidity, however, rapidly carbonated, obviously due to the growth of moulds in the culture foodstuffs. An important point which must be observed in making up caustic potash solutions for humidity control is to check the KOH content of the solid caustic potash. Rapid absorption of carbon dioxide takes place in the air and the caustic potash should be weighed out from material kept in a sealed container and a concentrated solution made up. The KOH content of this solution should then be estimated and diluted accordingly to give the required humidity. Difficulty may be met in making accurate solutions for 10% to 20% relative humidity as the solutions at these concentrations readily solidify on cooling.

Fahmy's (2) experiments showed that *Ptinus tectus* larvae and adults were killed by hermetic sealing, but a cork-glass seal does not constitute a complete air seal. In the experimental method outlined above, a large air space (approximately 1 litre) is left in the jar after the introduction of one litre of the humidity-controlling solution. In addition the humidity chambers were opened each week. Thus sufficient air was always present in the humidity chambers to allow of normal respiration.

METHOD USED FOR ISOLATING LIVE STAGES OF FOOD-INFESTING INSECTS.

A special sieve was constructed in which the infested foodstuff was sifted. The design was such that there was no possible chance of escape of eggs, small larvae, etc., through being "jumped" out of the sieve during the sifting operation. Allowance was made for making a rapid change to a gauze of different mesh. In addition, by unscrewing the body and top of the sieve after a sieving operation, the base, containing the gauze, can be placed directly on to the stage of the microscope for egg counting, etc., thus causing no possible loss due to transference. The cross wires of the sieving gauze also help materially in the counting.

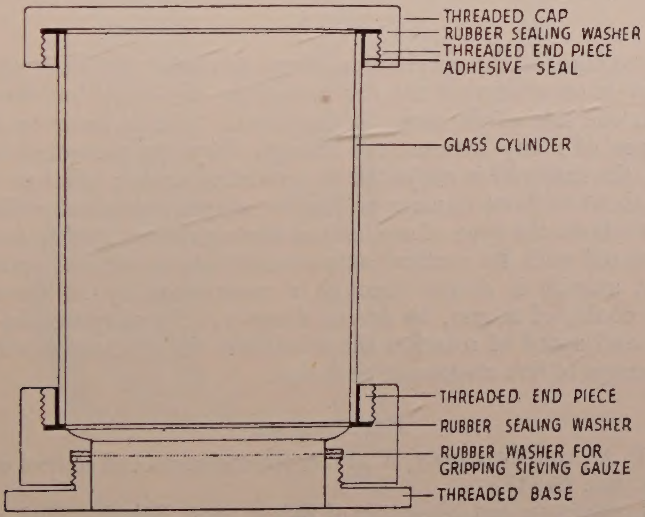


FIG. 3.

The sieve (fig. 3) consisted of a glass tube 3″ in diameter and 4″ in length. At each end a brass ring was cemented which was threaded on the outside face. A lid, machined out of brass, screwed on to one end of the cylinder. The gauze-holder screwed on to the other end of the cylinder, whilst a base was made to screw into the gauze-holder.

The complete sieve was made to fine dimensions, and in order to hold the gauze and to make satisfactory joints between the glass body of the sieve and the top and gauze-holder, accurately made rubber washers were used. By this means no minute crevices were left in which eggs and small larvae could be hidden. Circles of the sieving gauzes were cut so as to fit into the gauze-holder.

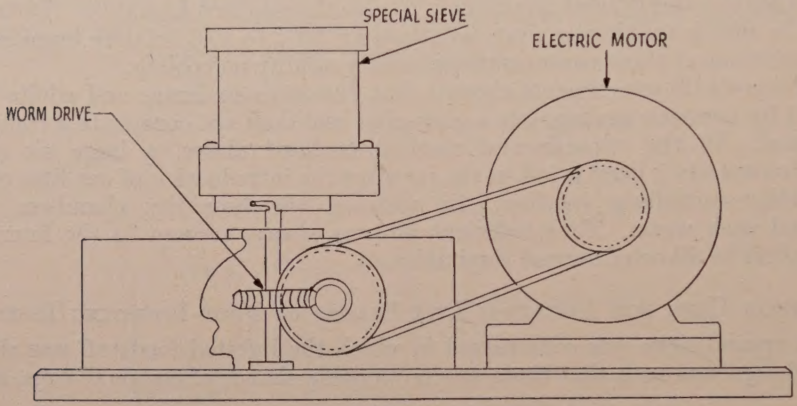


Fig. 4.

A disadvantage of the mechanical sieve proposed by Park (3) is that a vigorous blow is occasioned at the reversal of the stroke so that the material is thrown from one side of the sieve to the other. This is liable to damage the delicate pupae of many insects even though they are protected by cocoons. If, however, the material is subjected to a swirling action, efficient sieving can be brought about without damage to the live stages contained within it. The figure (No. 4) shows the type of mechanical sieving device used to do this. The sieve is mounted with its vertical axis eccentric to a vertical spindle free to rotate. The spindle is driven through a worm-gear by an electric motor. The spindle could, of course, be driven directly. By varying the amount of eccentricity and speed of rotation the conditions for efficient sieving together with non-damage to live stages can be found.

References.

1. Buxton, P. A., and Mellanby, K., 1934, Measurement and control of humidity. *Bull. ent. Res.* **25**: 171–5.
2. [Fahmy, I., Structure and Bionomics of *Ptinus tectus* Boield: With experiments on its Respiration and Vitality. Unpublished Thesis. Edinburgh.]
3. Park, T., 1934, Observations on the general biology of the Flour Beetle *Tribolium confusum*. *Quart. Rev. Biol.* **9**: 36–54.

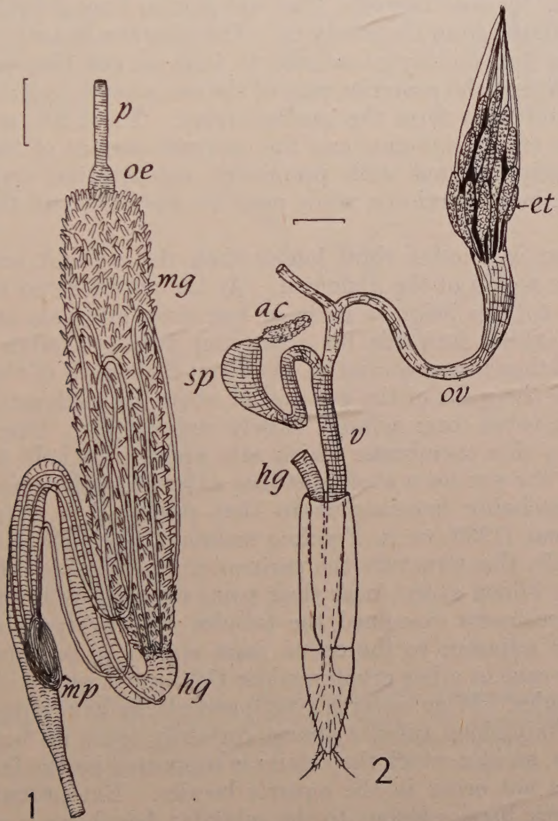
NOTES ON THE INTERNAL ANATOMY AND IMMATURE STAGES OF *MYCETOPHAGUS QUADRIPUSTULATUS* (LINNAEUS) (COLEOPTERA, MYCETOPHAGIDAE)

By H. E. Hinton, Ph.D., F.R.E.S.

Department of Entomology, British Museum (Natural History).

I. Introduction.

During the spring and summer of 1940 many adults and larvae of *Mycetophagus quadripustulatus* (Linnaeus) (1761) were taken at Linton, Cambridgeshire, feeding on many species of fleshy Hymenomycetes (*Pleurotus*, *Boletus*, *Polyporus*, etc.). The larva of this common species has been described by Frauenfeld (1867) and Xambeu (1900), but as both of these descriptions are unaccompanied by illustrations and as there exists no good description of the pupa, the opportunity is taken here of illustrating and describing the immature stages.



Figs. 1–2.—*M. quadripustulatus* (L.). (1) Alimentary canal. (2) Female reproductive system. (ac) Accessory gland. (et) Egg tube. (hg) Hind gut. (mg) Mid-gut. (mp) Malpighian tubules. (oe) Oesophagus. (ov) Oviduct. (p) Pharynx. (sp) Spermatheca. (v) Vagina.

The family Mycetophagidae consists of about 200 species grouped in some 20 genera of which the great majority, so far as is known, feed on fungi. There exists a diversity of opinion as to the relationships of the family, but to-day

PROC. R. ENT. SOC. LOND. (A) 16. PTS. 4–6. (JULY 1941.)

it is usually placed near the COLYDIIDAE. With a view to providing additional characters by means of which the relationships of this family can be better understood, the internal anatomy of the adult and larva has been described.

All illustrations were made by me with the aid of a camera lucida, and lines next to figures correspond to a length of 0·20 mm.

II. INTERNAL ANATOMY OF ADULT.

At the present time there appears to be nothing known of the soft parts of the internal anatomy of adult MYCETOPHAGIDAE. Sharp and Muir (1912) have described the endophallus (internal sac) as a simple tube. Crowson (1938) has described the metendosternite which he says is somewhat similar to that of the COLYDIIDAE.

1. *Alimentary Canal.*

The alimentary canal (fig. 1) has a short stomodaeum which is about one-fourth as long as the mesenteron. The oral part or buccal cavity is not structurally differentiated from the pharynx. The pharynx is a narrow tube which has its posterior end slightly broadened to form an oesophagus. There is no crop or ingluvies and the posterior part of the oesophagus is feebly invaginated into the mesenteron to form the cardiac valve. There are no caeca on the anterior margin of the mid-gut, and the external surface of the whole of the mid-gut is closely covered with prominent regenerative crypts which are about 0·08 mm. long anteriorly, while near the posterior end they are slightly shorter.

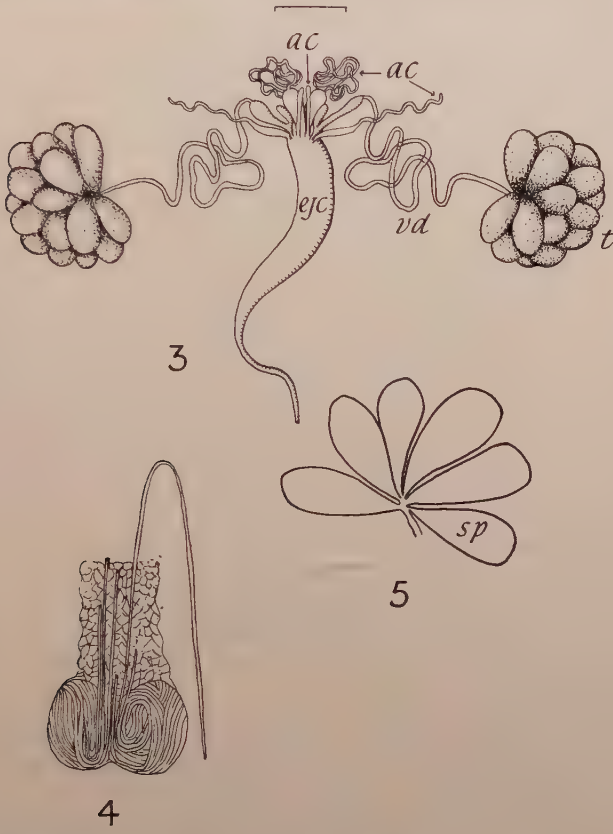
The hind gut is about a third longer than the mid-gut and has a single long loop in the region of the abdomen. At the anterior end of the hind gut six Malpighian tubules arise at more or less even intervals around the gut. These tubules extend forwards for a varying distance—often as far as the prothorax—and then turn posteriorly. At about the middle of the hind gut they lie very close to the walls of the gut and at about apical fourth, on inner side of loop, the six tubes form a large, closely coiled mass. Over this terminal coiled mass is a thin membrane which also appears to hold the Malpighian tubules against the gut for a short distance anterior to the coiled mass. This membrane is probably homologous to that described in *Niptus hololeucus* (Fald.) by Marcus (1930) or in *Tenebrio molitor* L. by Poll (1932). Wigglesworth (1939) calls this structure the perinephric membrane. The Malpighian tubules are pale brown except near their point of origin where they are white, but in a few specimens examined the tubules were everywhere white. The walls of the gut adjacent to the coiled mass appear to be thinner than elsewhere, as is the case in other cryptonephric Coleoptera with a similar arrangement of the tubules. Wigglesworth (1939) and others have suggested that this section of the Malpighian tubules almost certainly takes up water reabsorbed from the rectum, an idea which they claim is supported by the fact that cryptonephridism does not occur in the aquatic beetles. But probably more than half of the aquatic beetles belong to the suborder Adephaga, a suborder which in any case has no known cryptonephric terrestrial species. It has recently been shown by Hinton (1939) that among the Polyphaga there is one family (DRYOPIDAE) of the most truly aquatic of all beetles where cryptonephridism is the rule. Among the LIMNICHIDAE the most aquatic genus (*Lutrochus* Er.) is cryptonephric, while all of the three terrestrial genera (*Ersachus* Er., *Byrrhinus* Mots., and *Limnichites* Casey) that have been examined have the Malpighian tubules ending freely in the body cavity.

2. *Central Nervous System.*

The central nervous system has three discrete thoracic ganglia. The first abdominal ganglion is fused to the third thoracic, the second, third, and fourth are discrete, the fifth is contiguous to the sixth, and the sixth is contiguous to the fused seventh and eighth.

3. *Reproductive System.*

The male reproductive system is as shown in fig 3. The ejaculatory duct is a long, well-muscled tube which is variously coiled when retracted into the body. There are three types of accessory glands as shown in fig. 3. Each testis usually has 15 sperm tubes. One specimen examined had 18 sperm tubes to each testis, while one had 16 on one side and 20 on the other. The sperm tubes are sessile, *i.e.* they open directly into the vas deferens and there is no distinct vas efferens (fig. 5). The tubes are not collectively enclosed in a membranous sheath. In sexually mature specimens the vasa deferentia become enormously swollen and serve as vesiculae seminales, and when this



Figs. 3–5.—*M. quadripustulatus* (L.). (3) Male reproductive system. (4) Semi-diagrammatic view of cap of Malpighian tubules of larva. (5) Diagrammatic view of some sperm tubes. (ac) Accessory glands. (ejc) Ejaculatory duct. (sp) Sperm tube. (t) Testis. (vd) Vas deferens.

is the case the pouches near their point of entry into the ejaculatory duct are no longer evident. In sexually mature specimens the testes and vasa deferentia form a large mass occupying much of the body cavity above the last four abdominal sternites. The testes and vasa deferentia lie ventro-lateral to the gut.

The female reproductive system (fig. 2) has 17 acrotrophic egg tubes to each ovary. The accessory gland (ac) is connected by a short duct to the spermatheca (sp) which opens into the apex of the vagina. The apex of the vagina appears to serve as the bursa copulatrix, there being in this species no distinct and specialised part of the vagina, *e.g.* a diverticulum, which serves as a bursa copulatrix.

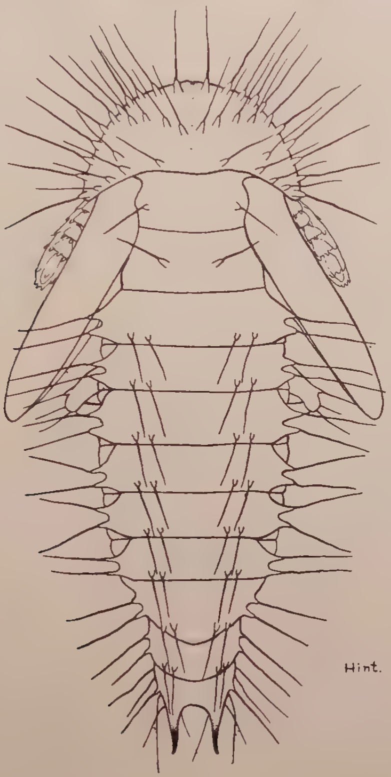
III. DESCRIPTION OF PUPA.

Two larvae taken under the bark of a rotten stump which had grown a few crops of a large *Polyporus* were placed in a jar with a piece of the fungus. Both made oval, nearly round cells in the debris under the fungus, and the cells could be seen by looking through the bottom of the jar. These cells were found completed on 9.viii.1940, and by the morning of the 13th both larvae had pupated. One of these was preserved in Pampel's fluid for description, and the other was allowed to emerge, which it did on the 20th—seven days after pupation. The length of the pupal period probably varies very greatly according to local conditions of temperature and humidity. My pupa was kept in a moist jar in a warm room. Xambeu (1900) gives 12 to 15 days as the length of the pupal period and Frauenfeld (1867) 16 to 20 days.

During the first few days the pupa was lying on its back, but on the fifth day it was found on its ventral side and just before emergence it was found on its side. Pupae have been found in the rotten wood and other debris under the bark of a tree stump. Dr. K. G. Blair has found the pupa actually in a large *Polyporus*, and Perris (1877 : 88) says he found a large number of larvae and pupae in *Boletus imbricatus* and larvae and pupae of a related species, *M. multipunctatus* Fabricius (1792), in *Boletus suberosus*.

When the adult first emerges it is a uniform testaceous colour. One which emerged on the morning of the 26th was entirely testaceous but by 11.30 p.m. the cuticle had darkened so that the two basal spots were quite distinct. By the 28th this specimen was fully coloured.

Female pupa : Length, 5·5–6·0 mm.; breadth (greatest breadth is across base of prothorax if wings are not included), 2·1 mm. Body oblong; cuticle white with reddish eyes and apical part of projections of ninth abdominal segment brownish. *Head* completely concealed from above by pronotum; surface with ten long setae on each side (fig. 7) as follows: two on clypeus; one opposite base of antenna; two in a line just above inner margin of eye; two more or less opposite these and nearer middle of head; one on extreme dorsal margin opposite inner margin of eye; and two on margin of gena, one opposite middle of eye and the other opposite posterior third of eye. Antennae extend posteriorly and slightly outwards to a point opposite anterior region of metasternum; surface with acute tubercles arranged as shown in fig. 6. Maxilla with a single long spine on outer side near base of last segment. *Pronotum* with shape and 40 setae as shown in fig. 6; on anterior fifth with a narrow, feebly impressed, median longitudinal line. Mesonotum with a single long seta on each side at posterior two-fifths near base of elytra; elytra extending posteriorly and slightly outwards to a point opposite posterior margin of third abdominal tergite; elytra without setae or tubercles. Metanotum on each side with a single long seta on posterior two-fifths; wing extending posteriorly and slightly outwards to a point opposite middle of fourth abdominal tergite. Abdominal tergites one to eight with shape and setae as shown in fig. 6; each tergite with four long setae on each side, two lateral and two on about lateral third of segment near posterior margin; ninth tergite with each posterior angle produced into a long, stout spine which is dark brown and heavily sclerotised at apex (fig. 6) and each side of this segment with five long lateral or ventrolateral setae. *Beneath* without setae on pro-, meso-, and metasternites. Abdominal sternites one to four transverse and with posterior and anterior margins more or less straight; one without setae; two to four with a single long seta on each side on posterior third or fourth of lateral fifth or sixth of sternite; five and six with posterior margin broadly arcuate and with setae as shown in fig. 8; seven without setae and with posterior part lobed (fig. 8) and each lobe enclosing one of the coxites of the female genitalia. *Legs* with front pair extending to middle of metasternite and tarsi separated by a distance equal to length of fifth segment. Second pair extending to middle of second abdominal sternite and with last three segments contiguous. Hind pair extending to posterior third of fourth abdominal sternite and with most of tarsi contiguous. Each leg with three long setae forming an oblique row on ventral apical part of femora. *Spiracles* of abdomen placed on sides and opening at level of cuticle, not on small tubercles.



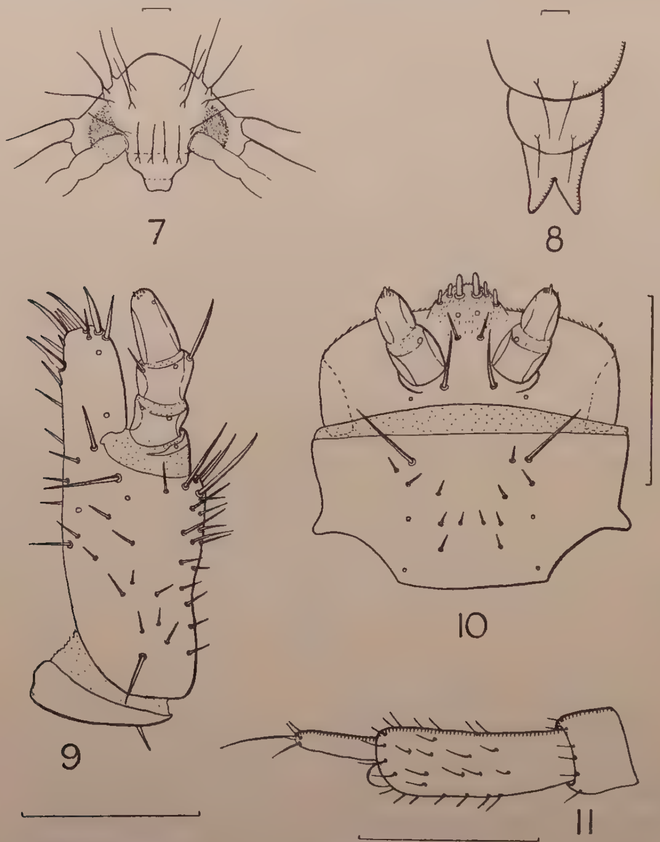
6

Fig. 6.—*M. quadripustulatus* (L.). Dorsal view of pupa.

Male : No male pupae were available, but when found they will be easily distinguished from the female by the three instead of four segmented tarsi of the front legs.

Comparative notes : The pupa of both *M. piceus* Fabricius and *M. fulvicollis* Fabricius has been described, the first by Perris (1877) and the second by Saalas (1923). The following key will serve to distinguish all known pupae of *Mycetophagus*.

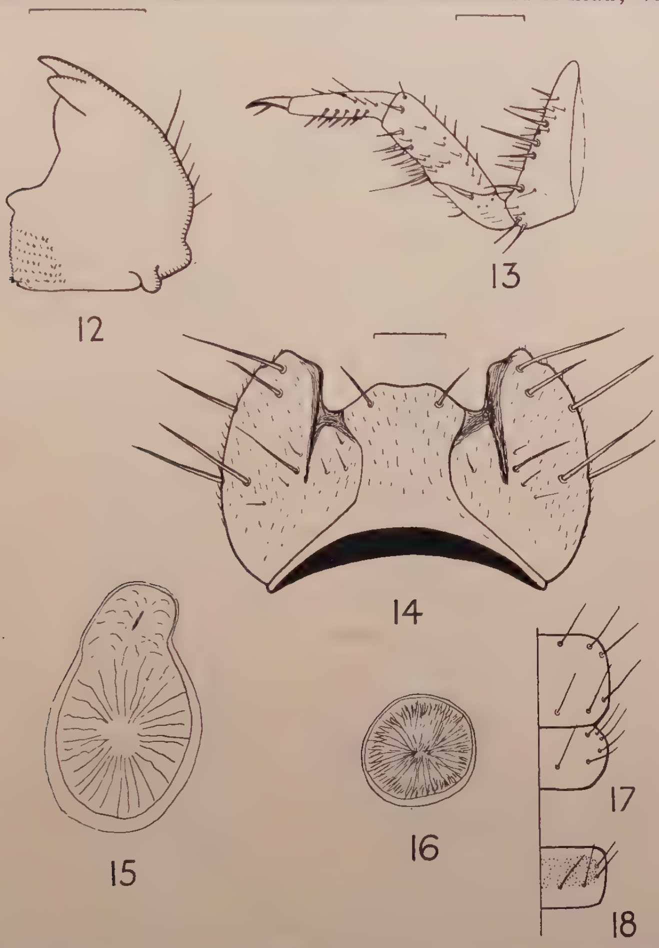
1. Meso- and metanotum with two setae on each side . *M. piceus* Fabricius (1792).
–. Meso- and metanotum with only one seta on each side . . . . 2.
2. First eight abdominal tergites with one seta on each side at about lateral third of segment near posterior margin. Ninth tergite with seven or eight setae on each side . . . . . . *M. fulvicollis* Fabricius (1792).
–. First eight abdominal tergites with two setae on each side at about lateral fourth or third of segment near posterior margin. Ninth tergite with five setae on each side . . . . *M. quadripustulatus* (Linnaeus) (1788).



Figs. 7–11.—*M. quadripustulatus* (L.). (7) Front view of head of pupa. (8) Ventral view of last three abdominal sternites of pupa. (9) Ventral view of left maxilla of larva. (10) Ventral view of labium of same. (11) Lateral view of antenna of same.

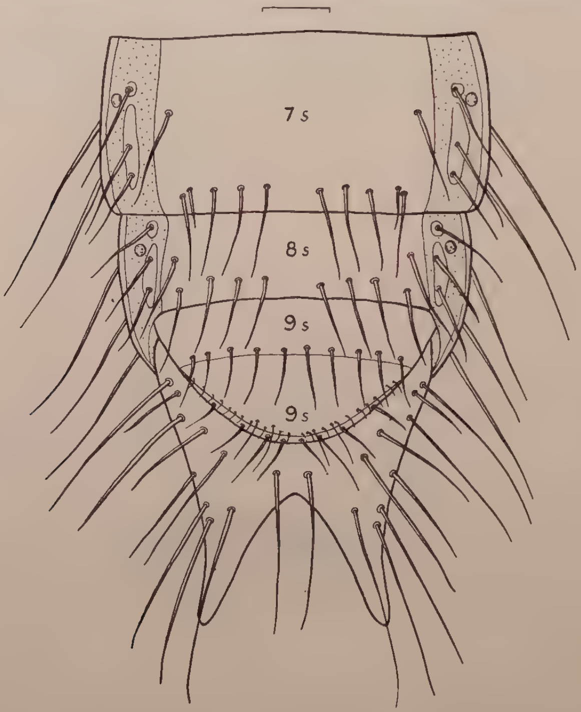
IV. Description of Larva.

Mature larva (figs. 4, 9–19) : Length, 8·5 mm.; breadth (across broadest point, which is near apex of metathorax), 1·0 mm. Elongate, subparallel, and more or less elliptical in cross section; dorsal surface evenly convex. Cuticle testaceous and with moderately dark brown areas as follows : head; anterior four-fifths of protergum and eighth abdominal tergite; anterior two-thirds of meso- and metatergum and sixth and seventh abdominal tergites; anterior half or slightly more of abdominal tergites one to five inclusive; and apical projection of ninth segment. *Head* slightly broader than long (1·04 mm. : 0·95 mm.); coronal suture short (0·05 mm.); frontal sutures diverging forwards in an irregularly curved line to a point opposite ocelli and then making a right angle turn to continue in a more or less straight line to anterior margin of head near outer side of antennal bases. Cuticle moderately sparsely clothed with suberect to erect, fine, short hairs and with five long, erect setae on each side as follows: one near anterior margin near apical angle; one opposite and lateral to point where frontal suture makes a right angle turn; and three forming a slightly oblique line on each side on basal third of head; ventral surface of head with setae as shown in fig. 14 (fine setae are only approximate); cuticle between setae moderately sparsely and usually transversely alutaceous. Five ocelli arranged on each side as follows: three in a transverse row opposite base of antenna; fourth smaller and posterior and slightly dorsal to first of row; and fifth just behind second of row. Antenna (fig. 11) as figured. Clypeus slightly longer than first segment of antenna; anterior margin truncate and angle on each side broadly rounded. Labrum with anterior margin broadly rounded and with about 10 moderately long setae; each side rounded and with five very long setae; labrum on each side at about anterior third with two very



FIGS. 12–18.—*M. quadripustulatus* (L.) larva. (12) Ventral view of left mandible. (13) Posterior face of left front leg. (14) Ventral view of head. (15) Mesothoracic spiracle. (16) Spiracle of fourth abdominal segment. (17) Diagram of long setae of pro- and mesotergum. (18) Same of first abdominal tergite.

long setae and elsewhere on surface with numerous much finer and shorter setae. Mandible (fig. 12) without a prostheca; each with two apical acute teeth and only right mandible with a short sub-apical third tooth; mola moderately depressed and with grinding surface facing buccal cavity [1] and also extending laterally over part of ventral side (fig. 12). Maxilla (fig. 9) with palp 3-segmented and galea and lacina completely fused; setae as figured. Labium (fig. 10) with palp 2-segmented; setae as figured. *Tergites* with numerous fine, short setae and also with a few very long erect setae. Protergum with six long, erect setae on each side as shown in fig. 17. Meso- and metatergum with six long, erect setae on each side as shown for mesotergum (fig. 17). Abdominal tergites one to eight with four long setae on each side placed as shown in fig. 18. Ninth tergite with two long dorsal setae on each side near base of apical projection, the other setae seen from dorsal view being ventro-lateral or ventral and are shown in fig. 19. *Sternites* and *pleura* of abdominal segments one to six more or less like those figured for segments seven and eight (fig. 19). Ninth sternum (fig. 19) as figured. *Legs* with front pair shortest and hind pair longest; posterior legs setose like front legs (fig. 13). *Spiracles* opening at level of cuticle in ventro-lateral pleural membrane on anterior third or half of segment; mesothoracic spiracle as figured (fig. 15); spiracles of first eight abdominal segments similar to that of fourth segment (fig. 16).



19

Fig. 19.—*M. quadripustulatus* (L.). Ventral view of end of abdomen of larva.

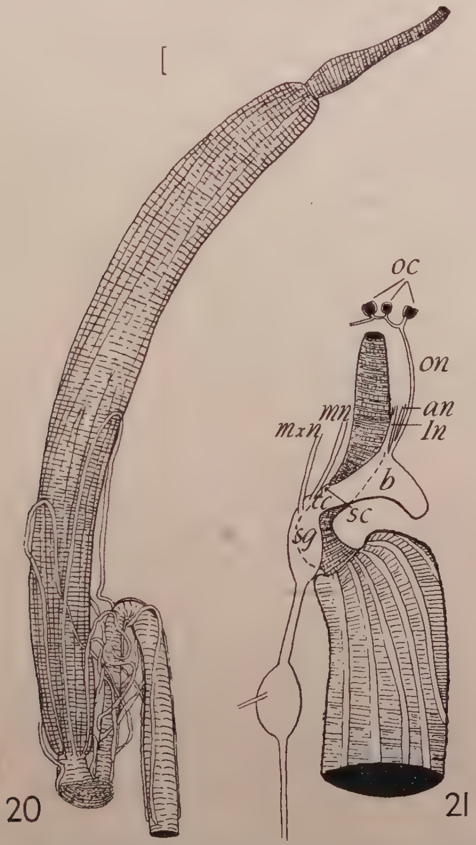
---

[1] Böving and Craighead (1931) say that the larvae of the Mycetophagidae can be distinguished from those of the Oedemeridae, Cephaloidae, Zopheridae, Synchroidae, and Pedilidae by having the mola of the mandible depressed and the grinding surface on the ventral or on both ventral and dorsal sides, whereas in the Oedemeridae, etc. the mola is not depressed and the grinding surface is facing the buccal cavity. I have examined the mandibles of *Typhaea stercorea* (Linnaeus) (1758) and find that they are similar to those of *M. quadripustulatus* in all important respects.

A number of larvae belonging to earlier instars has been examined, but the arrangement of the long setae in these is apparently the same as in the mature larva.

V. Internal Anatomy of Larva.

The larvae of a number of species of Mycetophagidae have been described, but the structures of the internal anatomy have been entirely neglected. Here the alimentary canal and the central nervous system of the larva is compared with that of the adult.



Figs. 20–21.—*M. quadripustulatus* (L.) larva. (20) Alimentary canal. (21) Lateral view of brain, suboesophageal ganglion, and first thoracic ganglion. (an) Antennal nerve. (b) Brain. (cc) Circumoesophageal connective. (ln) Labrofrontal nerve. (mn) Mandibular nerve. (mxn) Maxillary nerve. (oc) Ocelli. (on) Optic nerve. (sc) Substomodaeal commissure. (sg) Suboesophageal ganglion.

1. *Alimentary Canal.*

The gut (fig. 20) has a very short stomodaeum which is only about a fifth as long as the mesenteron, whereas in the adult it is about a fourth as long. The oral part of the stomodaeum or buccal cavity is not structurally differentiated from the pharynx. The pharynx is a narrow tube which has its posterior end slightly broadened to form the region known as the oesophagus. There is no distinct crop or ingluvies, and the posterior part of the oesophagus is feebly invaginated into the mesenteron to form the cardiac valve. In some specimens examined the gut was more or less full of food and there was no constriction between the stomodaeum and mesenteron, but in these cases the two structures could be distinguished by the arrangement of the muscles. The stomodaeum has the longitudinal muscles of the wall inside the circular muscles, whereas this arrangement is reversed in the mesenteron.

The mesenteron is a simple more or less parallel tube without caeca and without projecting regenerative crypts, as is the case in the adult. It is relatively much longer in the larva than in the adult.

The proctodaeum is slightly more than half as long as the mesenteron and has a single loop which extends as far anteriorly as the sixth abdominal segment. In the adult the proctodaeum is a third longer than the mid-gut. There are six Malpighian tubules which have their origin at the anterior end of the hind gut and arise at equal intervals round the gut. These tubules extend forwards for a varying distance before returning to the hind gut where they are variously coiled and looped and then come together to form a coiled cap (figs. 4 and 20) which covers the first bend of the hind gut. From this cap they extend closely applied to the walls of the hind gut to a point near the anus where they end blindly. Both the cap and the tubules caudal to the cap are covered by a thin " perinephric " membrane (fig. 4) similar to that already described for the adult. As has already been pointed out, in the adult the Malpighian tubules end in the coiled mass and do not extend along the walls caudal to this mass. In some specimens examined the Malpighian tubules were pale brown except near their point of origin and posterior to the coiled cap where they were white, while in other specimens they were white everywhere.

2. *Central Nervous System.*

The brain is as shown in fig. 21. The ventral chain has three thoracic and eight abdominal discrete ganglia. The larva has a greater number of discrete abdominal ganglia than the adult, and this appears to be the general rule among the Coleoptera and probably also among most other orders of insects.

VI. REFERENCES.

Böving, A. G., and Craighead, F. C., 1931, An illustrated synopsis of the principal larval forms of the order Coleoptera. *Ent. amer.* **11** : 1–351, 125 pls.

Crowson, R. A., 1938, The metendosternite in Coleoptera : a comparative study. *Trans. R. ent. Soc. Lond.* **87** : 397–415, 13 pls.

Frauenfeld, G. R., 1867, Zoologische Miscellen. XII. *Verh. zool.-bot. Ges. Wien* **17** : 775–784.

Hinton, H. E., 1939, An inquiry into the natural classification of the Dryopoidea, based partly on a study of their internal anatomy (Col.). *Trans. R. ent. Soc. Lond.* **89** : 133–184, 1 pl., 105 figs.

Marcus, B. A., 1930, Untersuchungen über die Malpighischen Gefässe bei Käfern. *Z. Morph. Oekol. Tiere* **19** : 609–677, 49 figs.

Perris, E., 1877, *Larves des Coléoptères* 1–590, 14 pls. Paris.

Poll, M., 1932, Contribution à l'étude des tubes de Malpighi des Coléoptères. Leur utilité en phylogénèse. *Rec. Inst. zool. Torley-Rousseau* **4** : 47–80, 19 figs.

Saalas, U., 1923, *Die Fichtenkäfer Finnlands.* **2.** Helsinki.

Sharp, D., and Muir, F., 1912, The comparative anatomy of the male genital tube in Coleoptera. *Trans. ent. Soc. Lond.* **1912** : 477–642, 36 pls.

Wigglesworth, V. B., 1939, *The principles of insect physiology.* London.

Xambeu, V., 1900, Moeurs et métamorphoses des insectes. II. *Rev. Ent., Caen* **19** : 1–56.

THE TERMINOLOGY USED BY JACOB HÜBNER

By Francis J. Griffin and Joséphine Griffin-Gillen.

Some years ago it became known to the senior author that there then existed in Germany the surviving manuscripts of Jacob Hübner apparently complete as they were left at his death. By a succession of fortunate circumstances they had survived the intervening century and were still unhurt, in fact until the war of 1914–1918 even the copper plates of the Hübner works were in existence and were only destroyed when commandeered by the German Government for use in war purposes. At that time the manuscripts were wrapped in several large bundles and stored in a dark corner in a Berlin warehouse and, fortunately, overlooked. The story of the survival of the documents is worth recording. On the death of Hübner his work was continued by Carl Geyer, who obtained charge of all unpublished material and the stock of the published works. Geyer continued the publication of the illustrations to the works and issued a very small amount of text, probably that part in an advanced state of preparation, but obviously he paid little attention to the great mass of it which required long study and much preparation to bring it to a state ready for publication. On the death of Geyer the whole collection passed to Herrich-Schäffer, who utilised certain of its contents but published no text, as such, to Hübner's works, although he regarded his own work as a continuation of, or possibly a replacement of, Hübner's. On the death of Herrich-Schäffer the whole of the remains, still obviously relatively complete, was acquired by the firm from whom the Society obtained possession with the assistance of one of its Fellows, Mr. R. W. Lloyd. The collection was secured as a result of a visit made to Germany by the senior author, who was able to agree to terms and to transport the very bulky parcels to London. The original patterns of the coloured plates of Hübner's works, and of Geyer's continuations, were obtained by the same means at a later date and now form a valued part of the National Collection in the British Museum (Natural History), where they are available for study by interested persons.

The collection of manuscripts, almost entirely in Hübner's own handwriting, was extremely extensive—it weighed some hundredweights—and has so far not been worked out thoroughly although we studied some part for Mr. Francis Hemming when he was preparing his work *Hübner* published by the Society in two volumes in 1937. That part was, however, restricted to such information as was concerned with, or threw light on, the dates of publication of the several works of Hübner and the Geyer continuations, and, in the nature of the subject, took little account of the great mass of unpublished material which was obviously intended by Hübner to form the basis for the text to his works. Our study of part of the manuscripts gave us a foretaste of their interesting contents and so attracted us to this strange author that we have from time to time made further efforts to study them. So far this examination is still not exhaustive and we can see no immediate likelihood of its becoming so in the near future. It has seemed better, therefore, to proceed piecemeal and endeavour to complete our results part by part, each in some measure complete in itself, yet forming an integral part of the whole.

PROC. R. ENT. SOC. LOND. (A) 16. PTS. 4–6. (JULY 1941.)

As a necessary prelude to such a study it is an obvious necessity to define the very unusual terms used by Hübner in his writings. It is evident to us that Hübner was a very determined man who held strongly the view that the tongue which he spoke and in which he wrote was to be a really pure " German " with no foreign influences; a doctrine not unfamiliar to our contemporaries to-day. It appears, however, equally apparent that he was of a shy, retiring, disposition and that he kept himself very much to himself. He was not a man of wealth and indeed was on occasions not unacquainted with the feeling of poverty. By a fortunate chance he was a meticulously careful man who made copious notes and these he kept carefully. Perhaps not so fortunately he was constantly revising his ideas and re-writing what he had already committed to paper. This is, we believe, the true reason for his not publishing a satisfactory text to his works. It is a habit not unknown to his countrymen and has been the cause of much labour to us, since it frequently took the form, with Hübner, of correcting, re-correcting, and again correcting, a manuscript with the result that it is now possible to decipher the writing only with extreme difficulty. Happily Hübner has left lists of some of the terms he used and one such has already been published in his *Lepidopterologische Zuträge*, 1820, of which a facsimile has been issued in Hemming's *Hübner* 1937, and by Griffin in *J. Soc. Bibl. nat. Hist.* **1** : 159–192, 1938. A second list has now come to light in the unpublished manuscripts in the Library of the Royal Entomological Society of London, and it is this which we now reproduce. The two lists are complementary and not duplicates, although of the 145 terms in our list 73 are common to both but, in some cases, with relatively unimportant variations.

In our list, which is in two parts, we have included in parenthesis [ ] those terms which are struck out in the manuscript by Hübner. The lists are on two sides of a leaf of paper and are written by Hübner, the first being the German list with the Latin equivalents and the second the Latin terms with the German equivalents. To this we have added, with the assistance of Dr. F. E. Zeuner, the modern terminology. In this connection we have utilised the list published by Hübner in 1820. It is a pleasure to record our thanks to Dr. Zeuner.

We have endeavoured to copy faithfully the words listed below and it should be assumed that any apparent errors in the German or the Latin as given above are copied from the original.

Körperliche Terminologie von der Schmettlinge Flieggestalten.

After	Anus	Anus
[Afterklappe	Valvula]	?supra-anal plate
[Afterdecke	Tegmen]	supra-anal plate
[Afterglied	Anium]	anal segment
Achsel	Axilla	shoulder
Anfang	Orsus	beginning
Arm	Armus	fore-leg
Arsch	Clonus	anus
Auge	Oculus	eye
[Bürzel	Culula]	the 2 abdominal segments next to the anal segment
vorderes	anteriora	
hinteres	posteriora	
Backen	Mala	" the sides of the head below the eyes," genae
Balg	Follis	pelt, skin
Bart	Barba	beard
Bärtgen	Barbula	small beard
Bauch	Venter	underside of abdomen

Borste	Seta	seta
Brust	Pectus	underside of thorax
Bürste	Scopa	tufts on first 6 abdominal segments
Bürzel	Culus	the 2 abdominal segments next to the anal segment
[Bürzelglied	Culula]	
Buge	Flexus	underside of tarsus
Decke	Tegmen	supra-anal plate
Deckgen	Tegilla	patagium
Dorne	Spina	
Dörngen	Spinula	spines on spur of leg
Ende	Extremum	end
[Ferse	Talus]	
Finger	Digitus	tarsal segment
Fläche	Pagina	upper and lower, surface of wing
obere	subjecta	
untere	dejecta	
Flügel	Ala	wing
Füge	[Junctura] *	articulation
Fuss	Pes	hind leg
Gegende	Tractus	area, region
Glied	Artus	mouthparts, palpi, eyes, antennae, legs, wings and abdominal appendage
Gliedgen	Articulus	segments of antennae, palpi and legs
Haar	Pilus	hair
Hand	Manus	tarsus
Halfter	Capistrum	halter
Hals	Collum	intersegmental skin connecting head and thorax
[Halsglied	Jugulum]	
Haut	Corium	integument
[Haber	Sypho]	?proboscis
Häutgen	Coriolum	?small, thin area of skin
Henkelgen	Ansula	frenulum—hook on fore-wing
Herzglied	Cardium	mesothorax
Höhle	Specus	cavity
Hüfte	Coxa	coxa of middle or hind leg
Hülle	Amictus	covering of scales and hairs
Joch	Jugum	prothorax
Kamm	Crista	crest, comb
Kegelgen	Conulus	basal segment of antenna
Kehle	[Gulae] Striatura	" part of the head below the mouth "
Kinn	Mentum	chin
Kläugen	Unguiculus	tarsal claw
Klammer	Fibula	clasp
Kläppe	Valva	" Two parts of the anal segment embracing the anus "
Klaue	Ungulus	tarsal claws
[Klufte] Knie	Genu	knee
Knospe	Gemma	" bud-like growth," a small prominence above the nostrils
Kopf	Caput	head
Krage	Collare	patagium
Kröpel	Cartilago	cartilage
Küppel	Copula	frenulum
Langer	Ulna	tibia
Läppgen	Lobulus	small lobe
Lappe	Lobus	lobe

---

* Added from the Latin list.

Leib	Corpus	body
Leite	[blank]	
Lende	Lumbus	
Lendglied	Lumbulus	
[Lenden]	[blank]	
Lenkung	Commissura	articulation of wings
Lippe	Labium	“ middle segment of palpus ”
Locke	Antia	“ hair tufts at base of antennae ”
Mäne	Juba	mane
Mitte	Medium	middle
Mündung	Orificum	margin of the mouth “ mostly extended into a proboscis ”
Mund	Os	mouth
Nase	Nasus	nose
[Polstergen	Cenchri]	prominences of the metathorax
Nacke	Cervix	occiput
Ohr	Auris	antenna
Panze	Thorassa	integument
Pfeifgen	[blank]	pulvilli
Pölstergen	Culcitrula	“ prominence of the metathorax ”
Rand	Margo	margin
Raum	Spatium	area between veins
Reger	Agini	“ posterior segment of palpus ”
Reistgen	Fasciculus	tuft of hair
Richtung	[blank]	
Rinne	Carina	?furrow, sulcus
Röhrgen	Fistula	a small pipe
Rücke	Dorsum	back of thorax
Rüssel	Proboscis	proboscis
Rüste	Tarsus	tarsus
Rumpf	Truncus	thorax
Sauger	Licitrix	
Saum	Fimbr	fringe
Scheitel	Vertex	vertex
Schiene	Tibia	tibia
Schildgen	Clypeolus	small shield
Schiengen	Tibiola	
Schloss	Anium	anal segment
Schnaube	Naris	nostril
Schnäuzgen	Rostella	“ anterior segments of palpus ”
Schneide	Acies	edge
Schöpfgen	Cirrulus	tuft
Schopf	Cirrus	tuft of erect hairs or scales on back of thorax
Schraube	Limes	
Schüppgen	Squammula	wing scale
Schultern	Humeri	?coxa of fore-leg
Schuppe	Squama	wing scale
Schwanzglied	Codum: 11tes Gl.	“ eleventh segment ”
Schweifgen	Codicula	small tail
Schwiele	Tomentum	pod
Schwinge	Jacta	fore-wing
Seite	Latera	side of thorax below the wings
Sene	Nervus	wing-vein
Senke	Vergens	hind wing
Sinnling	Sensorium	?sense organ
Sohle	Planta	sole
Speiche	Radius	?main vein

Steiss	Tergum	?back of last abdominal segment
Stirne	Frons	frons
Streichler	Palpus	palpus
Strotzling	Turgium	4 middle segments of abdomen between the "weichen" and "Bürzeln"
Stütze	Fulcrum	leg
Theil	Membrum	?segment
Theilung	Partitio	?partition, division
Träger	Gestor	middle leg
Waste	Armum	
Wange	Gena	eye-socket
Wanst	Abdomen	abdomen
Wehre	Lacerta	femur
Weiche	Ile	2 first segments of abdomen
Weichglied	Lumbium	metathorax
Wischergen	Penicilla	pencil of hairs
Wolle	Lana	wool
Zeugling	[blank]	?genital organ

Abdomen	Wanst
Acies	Schneideapfel
Acula	Kerbe
Agina	Reger
Ala	Flügel
Alvus	Leib
Amictus	Hülle
Anium	Afterling
Ansula	Henkelgen
Antia	Locke
Anus	After
Arm	Waste
Armus	Arm
Articulus	Gliedgen
Artus	Glied
Auris	Ohr
Barba	Bart
Barbula	Bärtgen
[Basis]	[blank]
[Capistrum	Halfter]
Caput	Kopf
Carina	Rinne
Cauda	Schwanz
[Cenchr]	[blank]
Cirrulus	Schöpfgen
Cirrus	Schopf
Clonus	Arsch
Clypeolus	Schildgen
Codicula	Schwänzgen
Collare	Halskrage
Collum	Hals
Commissura	Lenkung
Conulus	Kegelgen
Cordium	Herzglied
Corium	Haut
Corpus	Leib
Coxa	Hüft
Culcitrula	Polstergen
Culula	Bürzelglied
Culus	Bürzel
Digitus	Finger
Dorsum	Rücke
Exitus	[blank]
Extremum	Ende
Fasciculus	Reistgen
Fibiae	[blank]
Fistula	[Röhrgen] Pfeifgen
Flocca	Locke
Folles	Balg
Frons	Stirn
Fulcrum	Stütze
Gemma	Knospe
Gena	Wange
Gestor	Träger
[Gula	Kehle]
Humerus	Schulter
Jacta	Schwinge
Ile	Weiche
Ilius	Weichling
Juba	Mäne
Jugulum	Halsling
Junctura	Fuge
Labium	Lippe
Labrum	[illegible]
Lacerta	Wehre
Lana	Wolle
[Latebra	Höhle, Winkel]
Latus	Seit
Licitrix	Sauger
Limes	Schraube
Lobulus	Läppgen

Lobus	Lappe
Lumbulus	Lendling
Lumbus	Lende
Manus	Hand
Margo	Rand
Medium	Mitte
[Mentum]	[blank]
Naris	Schnaube
Nasus	Nase
Nervus	Sene
Oculus	Auge
Orificum	Mundung
Orsus	Anfang
Os	Mund
Pagina	Fläche
Palpus	Streichler
Paries	[blank]
Pectus	Brust
Penicilla	Wischgen
Pes	Fuss
Pilus	Haar
Planta	Sohle
Proboscis	Rüssel
Rostella	Schnauze
Sensorium	Sinnling
Seta	Borste
Spatium	Raum
Specus	Höhle
Spina	Dorn
Spinula	Dörngen
Squamma	Schuppe
Squammula	Schüppgen
Striatura	Kehle
[Talus	Ferse]
Tarsus	Rüste
Tegilla	Deckgen
Tegmen	Decke
Tergum	Steiss
Thorassa	Panze
Tibia	Schiene
Tibiola	Schiengen
Tomentum	Schwiele
Tractus	Gegend
Truncus	Rumpf
Turgium	Strotzglied
Valva	Klappe
Valvula	Kläppgen
Venter	Bauch
Vergentes	Senken
Vertex	Scheitel
Unguiculus	Kläugen
Ungulus	Klaue

BOOK NOTICE.

Essays in Philosophical Biology. By W. M. WHEELER. Selected by Professor G. H. PARKER. 8vo. Cambridge (Harvard University Press), 1939. Price 16*s.* 6*d.* pp. xv + 261, 3 pls., 6 figs.

This volume contains twelve essays which have already been published but have been selected by Prof. Parker partly because most of them are now out of print and partly because they "are utterly unique in the history of American Biology."

The essays here presented are: the ant-colony as an organism; Jean-Henri Fabre; on Instincts; the Termitodoxenia, or biology and Society; the organization of research; the dry-rot of our academic biology; emergent evolution and the development of Societies; Carl Akeley's early work and environment; present tendencies in biological theory; hopes in the biological sciences; some attractions of the field study of ants; animal societies.

The volume is prefaced by a short foreword and the appreciation of Wheeler originally published in *Science* in 1937.

Several of the essays were originally published in periodicals not normally available to entomologists and their appearance in this volume will bring them before the wider public.

The book is published in England by Sir Humphrey Milford (Oxford University Press).

PROTHETELY IN A LARVA OF *SMERINTHUS* HYBR. *HYBRIDUS* STEPHENS (LEPIDOPTERA)

By E. A. Cockayne, D.M., F.R.C.P., F.R.E.S.

Prothetely is a rare phenomenon in the Lepidoptera and none of the examples recorded is exactly like the one described in this paper. The earliest record of this abnormality is a larva of *Bombyx mori* L. described by Majoli in 1813. After the fourth ecdysis it had a small head with black faceted eyes placed close together and grey antennae. The thorax was narrow and the third somite was like that of a larva : there were two pairs of wings, grey in colour, the first pair long and narrow and the second pair shorter and still narrower. The abdomen was like that of a larva in form and number of somites. Very similar to this is a larva of *Melanippe montanata* described by Jones. It was one of twelve, which grew much faster than the rest, and in its last instar had pectinated antennae and imaginal legs. Harrison records a larva of the hybrid *Oporinia dilutata* Schiff. ♂ × *O. autumnata* Borkh. ♀. It was one of fourteen, which in the penultimate instar instead of moulting normally spun silken pads and remained motionless for a fortnight. Thirteen died owing to interference by other larvae caged with them, but the remaining one, which had been isolated, moulted after five weeks and then showed imaginal characters. It had a very small head, antennae with many segments, and eyes with both imaginal and larval characters. There were four rudimentary wings with vestiges of imaginal neuration, one 3 mm. long and three 1·75 mm. long. The legs approximated to those of an imago in structure. Kolbe gives a description and figures of a larva of *Dendrolimus pini* L. sent to him by Winneguth. It had long chitinised antennae with seven segments, large and abnormal maxillae, and legs, which were large and heavily chitinised. There were five other larvae with the same abnormality. They were reared from inbred stock. The first generation hatched in January 1902 and produced imagines in May. From a pairing of two of these a second generation was produced in June consisting of the six abnormal larvae. The imaginal characters were noticed after they had gone through three moults. The larva sent to Kolbe produced a small male moth.

On 11 June, 1940, Mr. H. B. Williams sent me three larvae of *Smerinthus* hybr. *hybridus* Stephens (*Smerinthus ocellatus* L. ♂ × *Laothoë* (*Amorpha*) *populi* L. ♀). Two were full-grown, but the third was in the penultimate instar. It fed on sallow and changed skin into the last instar on 24 July. Mr. Williams told me that it had grown much more slowly than the rest of the brood, most of which had pupated before 8 July. It appeared to be normal until the last instar, when it was seen to have developed a number of imaginal characters. As it was unable to eat I killed and preserved it on 25 July.

The antennae of the normal larva are very short and consist of three, or, according to some authors, four segments, all of which are green. In this abnormal larva the antennae are about 6 mm. long, the right consisting of seven and the left of six segments. The basal segment is broad, rounded, and green, the second is short and narrow, nearly spherical in shape, dark brown, and shining. The third is longer and much broader with two or three irregular grooves running across its surface. It is smooth, shining, and dark brown in colour. The fourth segment of the right antenna is much longer, dark brown with a polished surface crossed by transverse grooves on the anterior aspect. The fifth is somewhat distorted, tapering very much distally, dark brown in colour, with deep transverse grooves running round its circumference. The fourth segment of the left antenna is about 4·5 mm. long, dark brown with a polished surface crossed by transverse grooves, which become deeper distally. This segment corresponds with the fourth and fifth segments of the right antenna. The sixth segment of the right and the fifth segment of the left antenna are similar, very short, narrow, and pale brown in colour. The seventh segment of the right antenna is shorter and stouter than the sixth segment of the left, which is long and slender. Both these terminal segments are very pale brown and shining. From the inner and posterior aspect a very long colourless seta arises and to its outer side there are two hemispherical prominences on each of which is situated a short transparent conical seta, and still further out is a smaller prominence with a very small conical seta (fig. 2).

They bear a strong resemblance to the antenna of Kolbe's larva of *D. pini*. He considers that the two smooth chitinous basal segments correspond with the two basal segments of the imaginal antenna, which never have hairs or any organs of special sense on them. The transverse grooves of the more distal segments he regards as precursors of those segments of the imago, which carry the organs of special sense.

Accepting Kolbe's explanation, this would give 3 basal segments, 18 subsidiary segments, and 2 terminal segments (23 in all) in this hybrid larva compared with 46, including the large basal segment, in a male imago of *S.* hybr. *hybridus.*

The labrum is asymmetrical, somewhat incompletely developed, and has an aborted process on the left side. The mandibles have the usual cutting edge, but they are firmly welded together by a smooth shining heavily chitinised blackish-brown structure with bosses on its surface, and this accounts for the inability of the larva to feed (fig. 5). Below and behind the mandibles is a large asymmetrical structure with three lobes, which is presumably the lower lip. It is dark brown and has a polished surface. The middle lobe has several deep transverse grooves. It is probably the labium, but there is no trace of palpi or spinneret. The two outer lobes probably represent the maxillae. The smooth one on the right has two or three transverse grooves, but no palpus. That on the left has a wrinkled surface with deep grooves running across it, and from its outer and posterior surface arises a palpus with three segments. The proximal one is long and narrow, the middle one is shorter and broader. The distal segment arises from the rounded end of the middle one and is pointed, ending in two projections, a sharp one and a blunt one resembling a sensory cone (fig. 4).

On each side of the head is an ill-formed compound eye, semilunar in outline. It is black and shining with numerous grooves running more or less transversely across its surface, but no true facets are present. There are six ocelli on each side, those on the left differing a little in size and position from those on the right, of which a figure is given. The lowest ocellus should be a little lower than it is represented in the figure (fig. 3).

The legs are all abnormal. In the normal larva there are three well-defined segments. These are usually called the femur, tibia, and tarsus, although it is more probable that they are precursors of the imaginal tarsus, the other parts being hidden inside the thorax. The normal femur is green tinged with pink posteriorly, the tibia is pink, and the tarsus is deep pink with longitudinal wrinkles. The femur and tibia have a number of small pale mammillae on them, each giving rise to a seta. In this hybrid all parts of the legs are both longer and thicker than those of a normal larva. In the first pair of legs the femur on each side has on the outer aspect a small flat plate of dark brown chitin near the base and another raised one near the distal end. At the distal end of each femur of the second pair of legs there are two minute dots of chitin. Except for their size they are normal in other respects. All the tibiae are very abnormal. The basal part is pink with the usual pale mammillae-bearing setae, but at the distal end of each on the outer aspect is a plate of shining blackish-brown chitin with its surface irregularly ridged and bossed. On the first pair of legs the plate is very large on the right and rather smaller on the left. On the right there is a knob of chitin near the proximal end and on the left there are four knobs running up the outer aspect. On the second pair of legs the plates of chitin are much smaller. On the third pair the chitinous plates are very large, that on the right being both longer and broader than that on the left. The tarsi are all pale brown, highly polished, and have irregular transverse or longitudinal depressions. Each ends in a single claw, pale brown with a darker tip; that on the left leg of the third pair is, however, short and malformed. The uncontrolled development of chitin on the tibia represents an attempt to form a pupal or imaginal leg, and the highly polished tarsi with their pale brown chitin may also be regarded as an approach to the imaginal state.

On each side of the mesothorax there is a black oblique mark running downwards and forwards and on each side of the metathorax there is a similar, but much smaller, one. They appear to lie in the fourth subsegment. They must be wing buds (fig. 7). The horn is broad and short, being little more than a third of the usual length. It is green instead of blue and has the terminal part red (stippled with black in the figure) (fig. 8). The normal horn is blue with only the extreme tip pink (fig. 9).

The larva shows imaginal characters in its antennae and in possessing compound eyes. The mandibles, maxillae, and labium are abnormal, but their increased size and chitinised condition are imaginal. The chitinous plates on the femora and tibiae and the chitinised tarsi may also be regarded as an approximation to the chitinised condition of the legs of the imago. The black wing buds, which are still just visible in the blown larva, are evidence of an attempt to form imaginal wings.

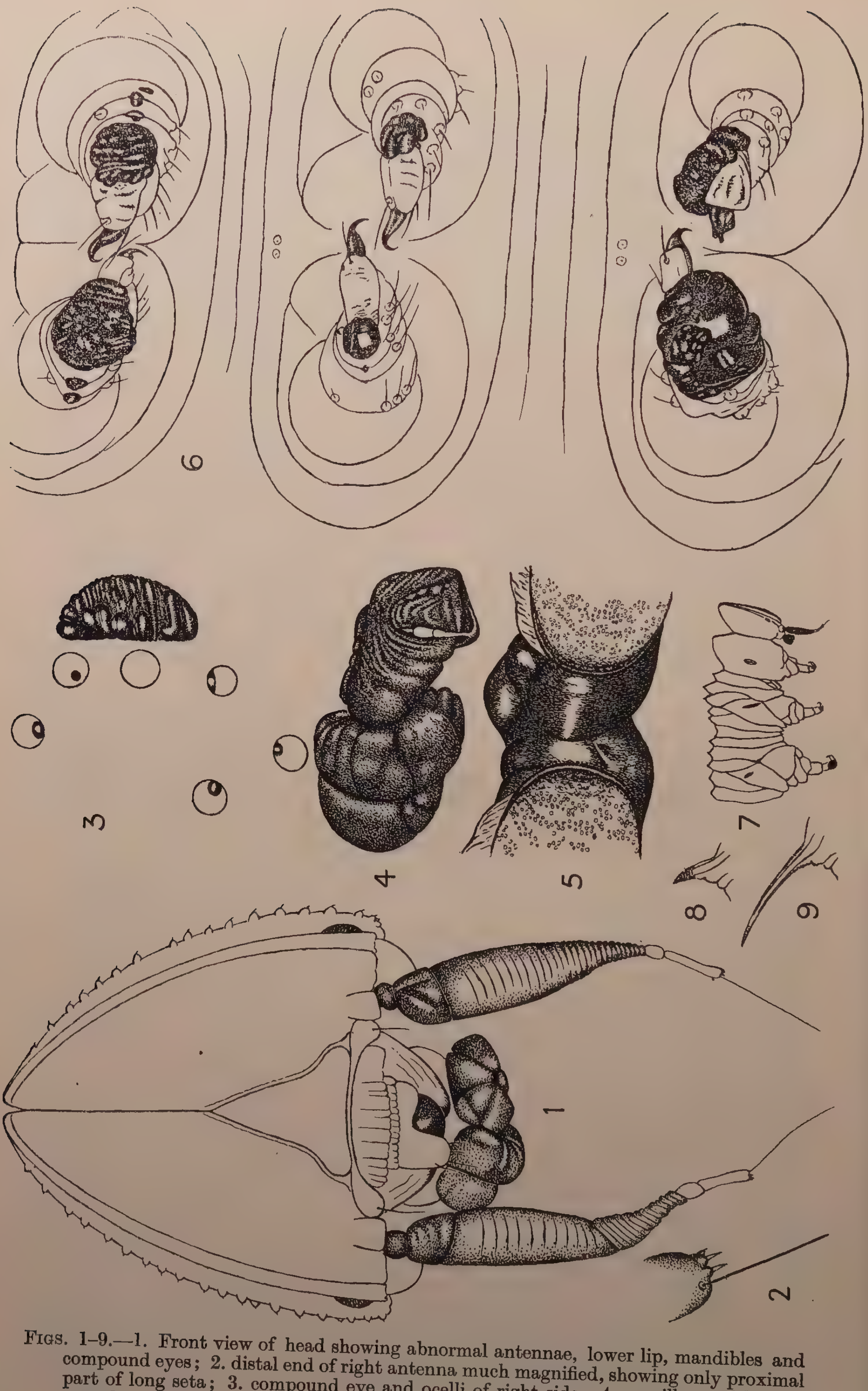
Its approach to the imaginal condition is less close than that of the larvae of the *M. montanata*, the *Oporinia* hybrids, and the *Bombyx mori*, but is closer than that of the larvae of *D. pini* and the hybrid *Lymantria*. It differs from all the other examples of prothetely in Lepidoptera in the great localised overproduction of ill-organised chitin in the maxillae, labium, mandibles, eyes, and legs.

Increased rate of growth was noteworthy in the larva of *Melanippe montanata*, and the larvae of *D. pini* grew quickly and reached maturity in the same summer instead of hibernating. On the other hand, the larva of the hybrid *hybridus* grew more slowly than the other members of the brood and the larvae of the hybrid *Oporinia* showed a remarkable delay in development. Some disturbance in the rate of growth seems to be usual.

It will be noted that two of the five previous records relate to hybrid larvae, a very high proportion in view of the fact that so few hybrid larvae come under observation. With the addition of this new example half the cases known to me have been hybrids and it seems probable that hybridisation plays some part in the production of prothetely.

Wigglesworth has shown that in the Hemipteron, *Rhodnius prolixus* Stål, the corpus allatum, a gland situated in the head, secretes a hormone which causes moulting, and another hormone, which in the earlier instars inhibits the development of adult characters. Distension of the abdomen after feeding is the stimulus which causes secretion, and the necessary concentration of moulting and inhibitory hormones takes place at a slightly variable time after feeding, the critical period. The inhibitory hormone, however, is only present in low concentration, and is secreted at a later period than the moulting hormone.

If the head is removed from a number of 4th-, 3rd-, 2nd-, and even 1st-stage nymphs around the critical period, some of them suffer a partial or complete metamorphosis, and it is possible to arrange them in an unbroken series with normal nymphs at one end, extreme adult forms at the other end, and all grades of intermediates between. In those showing partial or complete development of adult characters the head has been decapitated after the moulting hormone has been secreted, but before the inhibitory hormone has been secreted or before it has reached its full concentration.



FIGS. 1–9.—1. Front view of head showing abnormal antennae, lower lip, mandibles and compound eyes; 2. distal end of right antenna much magnified, showing only proximal part of long seta; 3. compound eye and ocelli of right side; 4. maxillae and labium seen from below and behind; 5. mandibles seen from below and behind; 6. legs, ventral view; 7. anterior part of larva showing wing buds; 8. horn of abnormal larva; 9. normal horn of *S.* hybr. *hybridus.*

If blood is transfused from a 5th-stage nymph decapitated after the critical period into a 4th-stage nymph decapitated 24 hours after feeding, *i.e.* before the critical period, both moult simultaneously and the 4th-stage nymphs are found to have suffered premature metamorphosis and to have developed all the adult characters. If 4th-stage nymphs decapitated 5 days after feeding are united to 5th-stage nymphs decapitated 24 hours after feeding, both moult and while 5th-stage nymphs show slight imperfection of metamorphosis the 4th-stage nymphs show almost complete metamorphosis. If the experiment is repeated with 4th-stage nymphs decapitated 6, 7, and 8 days after feeding, when more inhibitory hormone is present, the 5th-stage nymphs produce adults of both sexes with incompletely formed genitalia and wings intermediate between those of 5th-stage nymphs and adults and the 4th-stage nymphs again develop adult characters, but not as a rule so complete as in the first experiment.

Implantation of the corpus allatum from 3rd- and 4th-stage nymphs in the abdomen of 5th-stage nymphs produces in some cases characters intermediate between those of nymph and adult, a condition not seen in normal *Rhodnius* at any stage.

These experiments suggest that prothetely and hysterotely (metathetely) are due to a disturbance in the hormones, which regulate metamorphosis. For the secretion of the moulting hormone precedes that of the hormone inhibiting metamorphosis, and if the earlier nymphal stages are decapitated before the latter is fully formed, they develop adult characters in greater or lesser degree (prothetely). On the other hand, if 5th-stage or final stage nymphs receive the blood of earlier nymphs containing the inhibitory hormone they develop into adults showing imperfect metamorphosis (hysterotely or metathetely).

Presumably, in lepidopterous larvae which exhibit prothetely, there is a deficient secretion of the hormone which inhibits metamorphosis, but as yet we have no clue to the cause of this naturally-occurring endocrine disorder. Though there is evidence that the corpus allatum in Lepidoptera has the same function as in Hemiptera, the stimulus which causes secretion is still unknown.

These abnormal lepidopterous larvae do not show a condition which is present at any stage of normal development or one which is truly intermediate, and in this respect they differ from the experimental *Rhodnius*. The curiously selective action of the hormone in all the recorded examples, causing partial metamorphosis in certain structures and no change in others, is not easy to account for, and the entirely abnormal growth of the structures showing partial metamorphosis in the *Smerinthus* hybr. *hybridus* larva is difficult to explain in terms of a simple deficiency of inhibitory hormone.

It is possible that the corpus allatum, like the vertebrate pituitary gland, secretes several hormones, and, if this is so, valuable clues to their nature may be derived from the study of natural examples of prothetely, such as the one described in this paper.

REFERENCES.

HARRISON, J. W. H., 1920, *J. Genet.* **9** : 268.
JONES, E. H., 1883, *Entomologist* **16** : 121.
KOLBE, H. J., 1903, *Allg. Z. Ent.* **8** : 1–9, 25–30.
LINDNER, E., 1915, *Z. wiss. InsektBiol.* **11** : 244.
MAJOLI, C., 1813, *G. Fis. Chem. Stor. nat. Ital., Pavia* **5** : 399.
WIGGLESWORTH, V. B., 1934–35, *Quart. J. micr. Sci.* **77** : 191.
——, 1936–37, *Ibid.* **79** : 91.
WINNEGUTH, G., 1912, *Insektenbörse* **29** : 29.

Book Notice.

Insect Transmission of Plant Diseases. By J. G. Leach. Pp. xviii + 615, 238 figs., front. 8vo. London (McGraw-Hill), 1940. Price 42*s*.

This volume is one of the series " McGraw-Hill Publications in the Agricultural Sciences " and the author of it is Professor of Plant Pathology in West Virginia University.

The seventeen chapters are entitled Introduction; the inter-relationships of plants and insects; symbiosis between insects and microorganisms and its significance in plant pathology; the relation of insects to the spread and development of plant diseases; plant diseases caused by toxicogenic insects; insects and bacterial diseases; insects and fungus diseases; insects and virus diseases (2 chapters); insects and phytopathogenic protozoa; mites, nematodes, and other small animals as vectors of plant diseases; the anatomy and physiology of plants in relation to infection and insect vectors; the anatomy and physiology of insects in relation to the transmission of plant diseases; the inocula of plant pathogens in relation to insect transmission; the feeding and breeding habits of insects in relation to the transmission of plant diseases; insect transmission of animal diseases compared with insect transmission of plant diseases; and methods useful in the study of insect transmission of plant diseases.

In an appendix is a series of tables showing diseases and their vectors; insect vectors and the disease they transmit; and a comparison of some fungus diseases in respect to transmission phenomena; virus diseases and bacterial diseases. The book is completed by a glossary and index and at the end of each chapter is a list of literature.

The author " has endeavoured to bring together in one publication the most important contributions " and " to evaluate and interpret the evidence in the light of more recent advances in entomology and plant pathology."

Book Notice.

The Microscope. By R. M. Allen. 8vo. London (Chapman and Hall), 1940. Price 15*s.* 0*d.* pp. viii + 286, 18 pls. (col.), 82 figs.

The seven chapters of this book are entitled: historical introduction; optical principles of the microscope; modern instruments; illumination; testing of microscope objectives; getting the most out of the microscope; preparation of material for microscopical examination. The book is completed by a short Bibliography, Glossary and an Index.

The illustrations are mainly concerned with instruments commonly met with in the United States of America, where the book was printed, and the technique described is that evolved in the author's own laboratory.

The book is printed throughout on a coated paper in order to reproduce satisfactorily the many half-tone illustrations printed in the text.

ACTIVITY OF *GLOSSINA PALLIDIPES* AND THE LUNAR CYCLE (DIPTERA)

By F. L. VANDERPLANK, B.Sc.

(*Tsetse Research Department, Tanganyika Territory.*)

Introduction.

THE locality and conditions in which the following experiments have been carried out will be described in a future paper. The observations below are from catches of *Glossina pallidipes* Austen made with bait oxen. Two methods were used :—(1) Moving Rounds : an ox was led along the thicket path and stopped at short intervals to enable the catchers to search for tsetses; (2) Stationary Catches : an ox was tethered at some point along the thicket path and the tsetses caught as they alighted on the animal.

From January to October 1939 moving catches were made practically every day, excepting Saturdays and Sundays, and the stationary catches were made six to eight times a month from 8.0 a.m. to 6.0 p.m. East African Standard Time. From October 1939 to May 1940 the moving catches were made six times a month and the stationary catches daily, except Saturdays and Sundays, from 2.0 p.m. to 5.45 p.m. East African Standard Time.

Examination of the daily male and female totals of *pallidipes* caught revealed that the numbers fluctuated to a 28–29-day cycle, correlated with the lunar cycle.

Observations.

Moving Rounds.

In the first instance the daily total (male and female) catches on days following light nights (*i.e.* during second and third lunar quarters) were tested for significance against the daily total catches on days following dark nights (during the first and fourth lunar quarters). This difference was found to be highly significant.

The mean total catches (male and female) arranged against the lunar phase are shown later in Table II. Since it was desired to be able to correct the old male catch for this phenomenon, the daily total male catches off ox were arranged in the following manner :—commencing with the day following the new moon as day one, the days following were numbered two, three, etc. up to full moon, when the numbering was reversed so that days following nights of equal moonlight received the same numbers. The male *pallidipes* catch per round was then correlated with this ascending magnitude of moonlight. Since the intensity of moonlight arranged in this manner would theoretically give a slightly " S "-curved line, this arrangement will be inaccurate at both extremities. The correlation coefficient (r) obtained was $-$ 0·4236, the number of observations was 282 and P was less than one in a hundred.

Stationary Catches.

These catches were also examined for a significant difference between the mean total (male and female) *pallidipes* caught on days following dark nights (first and fourth quarters of the moon) and the mean total *pallidipes* caught on days following light nights (second and third quarters). The results are set out below in Table I.

TABLE I.

Month	Catches following light nights			Catches following dark nights		
	No. of ¼-hour catches	Total males and females	Mean per 2½ hours	No. of ¼-hour catches	Total caught	Mean per 2½ hours
April	31	21	6·8	33	35	10·6
May	32	15	4·7	32	22	6·9
June	33	16	4·9	31	119	38·4
"	33	37	10·3	33	80	24·2
July	30	51	17·0	31	75	24·2
"	31	34	11·0	31	74	23·9
August	31	89	28·7	30	80	26·7
"	0	—	—	31	84	27·1
September	44	50	11·4	32	76	23·7
"	21	10	4·9	29	164	56·6
"	44	80	18·2	31	93	30·0
November	15	11	7·3	32	32	10·0
"	44	47	10·7	41	300	73·2
"	44	48	10·9	46	226	49·1
Total	433	509	11·8	463	1460	31·5

The differences between these means are highly significant.

When the male *pallidipes* catch was correlated with the lunar cycle in the same way as described for the moving rounds above, $r = -0{\cdot}7845$, and the number of observations was 2277, the results being highly significant. The female catch was treated in the same way and with $r = -0{\cdot}6956$, and 2277 observations, this result is also highly significant.

Graph.

The graph shows the mean total (male and female) *pallidipes* catch per 7½ hours for both the moving and stationary catches, arranged according to the position of the day, on which they were carried out in relation to the lunar cycle. These means have been based on catches made between January 1939 and the end of July 1940. This graph shows two "S"-shaped curves which would correspond to the expected lunar light of the nights preceding the catch. The data obtained are shown in Table II.

The moving catches show a greater variation in the amplitude of the cycle than the stationary catches. This is due to the fact that more *pallidipes* were taken in the same period of time on the moving catches than on the stationary, because the former method takes non-hungry males searching for females whereas the latter only takes the hungry ones looking for food.

TABLE II.

Lunar cycle, day	¼-hour periods	Stationary, mean total per 7½ hours	¼-hour periods	Moving catches, mean total per 7½ hours
1	150	15·2	45	25·0
2	56	14·9	0	—
3	75	14·3	30	22·0
4	41	11·5	51	18·6
5	89	14·1	93	15·4
6	225	13·8	132	12·3
7	46	11·6	27	13·2
8	63	12·9	0	—
9	75	10·7	21	8·4
10	20	12·1	33	10·1
11	116	12·3	63	16·0
12	110	13·6	99	18·5
13	96	15·3	129	20·3
14	27	16·5	105	26·4
15	132	15·4	84	31·2
16	56	16·1	45	32·4
17	30	17·0	51	35·8
18	42	16·9	24	34·6
19	63	18·6	66	42·4
20	123	19·5	63	49·3
21	93	21·2	141	55·6
22	61	24·3	108	54·3
23	145	26·5	126	55·8
24	131	28·0	0	—
25	52	27·8	21	63·7
26	93	30·4	69	51·2
27	62	25·1	54	47·6
28	230	18·7	81	43·3
29	110	16·6	15	30·0
1	150	15·2	45	25·0
2	56	14·9	0	—
etc.				

Activity of pallidipes *at Night.*

The inference to be drawn from the above data is that *G. pallidipes* feeds on moonlight nights and does not feed so freely, if at all, on dark nights. Some data have been collected concerning the activity of *pallidipes* at night.

During April 1940 a moving round was commenced at 9.30 p.m., on the day before full moon, using an adhesive screen. The barrier path was transversed and no *pallidipes* were taken. On the return journey a game path running outside the barrier was used and three male *pallidipes* were taken on the screen. The author and another European accompanying the party were both bitten by tsetses, which were most likely *pallidipes* since *G. swynnertoni* was very scarce in this area. The return journey commenced at 10.30 p.m. and ended at 11.30 p.m.

J. Y. Moggridge, Junior Entomologist of the Department, has reported (unpublished) the taking of male and female *pallidipes* in small numbers at all hours of the night on both moonlight and dark nights at Kilifi, Kenya.

Summary.

(1) An account is given of observations showing that the numbers of *pallidipes* caught on days following moonlight nights are significantly fewer than the numbers caught on days following moonless nights. Two methods of catching *pallidipes*, (*a*) moving round and (*b*) stationary catches, were used and the data from them treated separately.

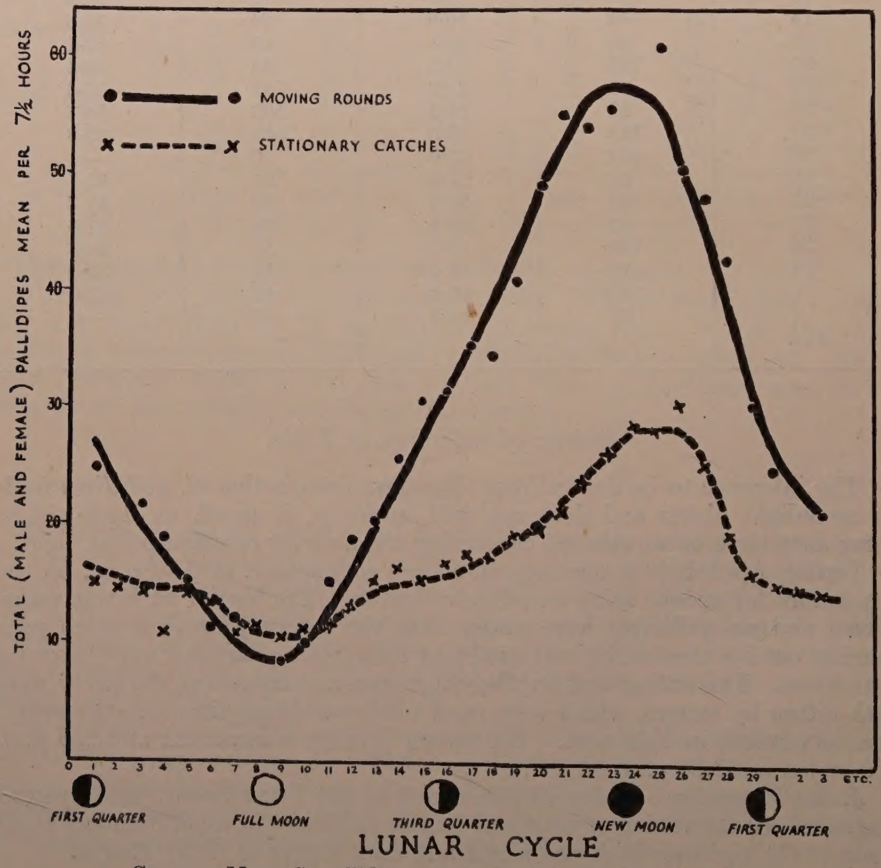
(2) The results of correlating the *pallidipes* catch with the amount of moonlight on the previous night are given for both moving and stationary catches. The correlations were highly significant.

(3) A table and graph showing the mean total (male and female) *pallidipes* catches against the corresponding phases of the moon for both methods of catching are given. The graph shows an " S "-shaped curve in both cases.

(4) The inference is drawn that *pallidipes* is more active on moonlight nights than dark nights and so less active during the following day, and a few observations on the taking of *pallidipes* at night are mentioned.

Acknowledgments.

Thanks are due to Mr. W. H. Potts, Senior Entomologist, and Dr. C. H. N. Jackson, Senior Entomologist, for their interest and help with this work. Also to Mr. J. Y. Moggridge, Junior Entomologist, in his absence on Active Service, for the data used from unpublished reports.



Graph.—Mean *G. pallidipes* catch in relation to lunar cycle.

PUBLICATIONS

The Publications of the Royal Entomological Society are *Transactions* and *Proceedings*.

The *Transactions* form an annual volume, each paper in the volume being issued as a separate part. The parts are issued irregularly throughout the year.

The *Proceedings* are issued in three series:

Series A. General Entomology
Series B. Taxonomy
Series C. Journal of Meetings

Series A and B are issued in twelve parts, forming an annual volume of approximately 240 pages.

The following information is supplied for the guidance of authors wishing to submit papers for publication in any of the Society's journals.

INTRODUCTORY

The Society is prepared to undertake the provision of a reasonable number of text figures. The original drawings for such figures must be supplied by authors. Such drawings or groups of drawings must be drawn to a scale which will permit of their reduction to an area of dimensions not exceeding 7¾ × 4¾″. In the case of the *Proceedings Series A* and *Series B*, authors are required to pay for the necessary blocks for the provision of plates, half-tone and coloured work.

A uniform method is adopted for the citation of bibliographical references in the Society's publications as follows:

> Smith, A., 1936, New species of Coccidae, *Proc. R. ent. Soc. Lond.* (B) **6** : 301–306, pl. 1.
>
> ——. 1936, New species of Coccidae, *Trans. R. ent. Soc. Lond.* **84** : 901–936.

Titles of periodicals cited are to be abbreviated in the manner indicated in the *World List of Scientific Periodicals, 2nd edition*, 1934.

Authors are entitled to receive 25 copies of their papers free of charge and may purchase additional copies provided that request be made before publication.

Papers offered for publication should be sent to the Secretary, Royal Entomological Society of London, at *41, Queen's Gate, London, S.W.7*, and must be typewritten on one side of the paper only. Sufficient space must also be left between the lines for editorial corrections.

The copyright of the Society's publications is vested in the Society.

TRANSACTIONS

Papers offered for publication in the *Transactions* are considered by the Publication Committee of the Society, which meets usually in the months of May and November. In order that papers may be considered at these meetings it is necessary for the manuscript and drawings for any illustrations to be in the hands of the Secretary fourteen days before the meeting of the Committee.

Papers of less than eight printed pages (approximately 7000 words) will not normally be accepted for the *Transactions*, and papers by authors who are not Fellows of the Society must be communicated by a Fellow.

PROCEEDINGS SERIES A AND SERIES B

Papers submitted for publication in either *Series A* or *Series B* of the *Proceedings* by authors who are not Fellows of the Society may be accepted if they are communicated by a Fellow. Preference will be given to papers written in the English language, and papers of more than eight printed pages (7000 words) will not normally be accepted for publication in these journals.

PROCEEDINGS SERIES C

Series C is issued prior to every General Meeting. It contains abstracts of exhibits to be shown and communications to be made, together with the titles of papers accepted for publication.

The annual subscription to *Series A. General Entomology* is *£1 4s. od.; Series B. Taxonomy, £1 4s. od.* (single parts *3s. od.*); and *Series C. Journals of Meetings, 6s. od.*

As from January 1936 the journal *Stylops* is continued as *Proceedings Series B. Taxonomy.* Copies of volumes 1–4 are available at *£1 16s. od.* each, post free.

MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W.7

1941.

WEDNESDAY, October 1
" November 5
" December 3

1942.

" January 21 (ANNUAL MEETING)
" February 4

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

The Fellowship and Fees

Fellows pay an Admission Fee of £3 3*s*. The Annual Contribution of £2 2*s*. is due on the first day of January in each year, and is payable in advance. Fellows under the age of 25 years may pay the entrance fee in three equal annual instalments.

Fees should be paid to the Treasurer, at 41, Queen's Gate, S.W.7, and *not to the Secretary.*

Fellows desiring to pay their Annual Contribution through their bankers may obtain an official form of banker's order by applying to the Treasurer.

Fellows whose Contributions for the current year have been paid are entitled to receive the *Transactions* and *Proceedings* of the Society free of charge. Further copies may be purchased at reduced prices by applying to the Registrar.

Forms of application for Fellowship, copies of the Bye-Laws and the List of Fellows may be obtained from the Registrar.

Meetings and Exhibitions

Fellows and others wishing to make a communication to a General Meeting of the Society are requested to send in their names, the title of their exhibit, and a short abstract of their remarks, to the Registrar fourteen days before the meeting at which it is proposed to make the communication. Should it be desirable to publish a fuller account of the communication the manuscript may be submitted for publication in *Proceedings Series A* or *Series B*. If the epidiascope is required, 24 hours' notice must be given. Objects for projection should not exceed 6 ins. by 6 ins.

Fellows resident abroad, or otherwise unable to attend meetings, are reminded that notes or observations sent to the Secretary may be communicated to a General Meeting on their behalf.

PRINTED FOR THE SOCIETY BY RICHARD CLAY AND COMPANY, LTD.,
BUNGAY, SUFFOLK.